ASSIGNMENT 2

Textbook Assignment: "The Screw," chapter 5, pages 5–1 through 5–4; "Gears," chapter 6, pages 6–1 through 6–8; "Work," chapter 7, pages 7-1 through 7–6; and "Power," chapter 8, pages 8–1 through 8–4.

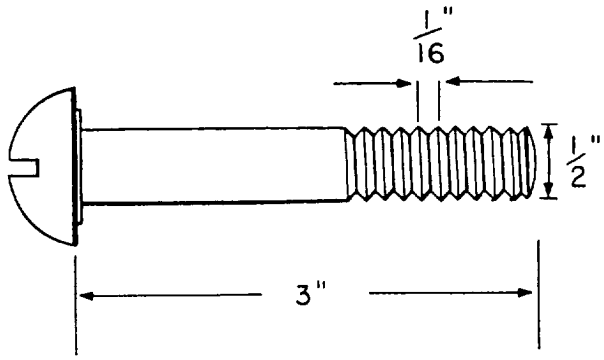

Figure 2A

2-1. What is the pitch of the screw in figure 2A?

1. 1/16 in
2. 1/2 in
3. 1 4/7 in
4. 3 in

2-2. Upon which measurements does the theoretical mechanical advantage of a jackscrew depend?

1. Pitch and length of the screw
2. Length of the jack handle and radius of the screw
3. Pitch and radius of the screw
4. Length of the jack handle and pitch of the screw

2-3. How do you find the theoretical mechanical advantage of a jackscrew?

1. Divide the amount of resistance by the amount of effort required to overcome the resistance
2. Multiply the length of the jack handle by the radius of the screw and then divide by the length of the screw
3. Multiply the length of the jack handle by 2π and then divide by the pitch of the screw
4. Divide the length of the jack handle by 2π and then multiply by the pitch of the screw

2-4. High friction losses are built into a jackscrew in order to prevent the

1. screw from turning under the weight of a load as soon as the lifting force is removed
2. screw from becoming overheated when a load is being lifted
3. threads of the screw from being sheared off by the weight of a load
4. jack from toppling over as soon as the lifting force is removed

2-5. If a screw has a pitch of 1/16 inch, how many turns are required to advance it 1/2 inch?

1. 2
2. 8
3. 16
4. 32

2–6. If the handle of a jackscrew is turned 16 complete revolutions to raise the jack 2 inches, the pitch of the screw is

1. 1/32 in
2. 1/16 in
3. 1/8 in
4. 1/4 in

2–7. You are pulling a 21–inch lever to turn a jackscrew having a pitch of 3/16 inch. The theoretical mechanical advantage of the jackscrew is about

1. 1,000
2. 700
3. 400
4. 100

2–8. A jackscrew has a handle 35 inches long and a pitch of 7/32 inch. If a pull of 15 pounds is required at the end of the handle to lift a 3,000–pound load, the force expended in overcoming friction is

1. 12 lb
2. 9 lb
3. 3 lb
4. 5 lb

2-9. Refer to textbook figure 5–3. How many complete turns of the thimble are required to increase the opening of the micrometer by 1/4 inch?

1. 25
2. 10
3. 5
4. 4

When answering items 2–10 and 2–11, refer to textbook figure 5–4.

2–10. If the micrometer's thimble is turned exactly five complete revolutions, the new reading is

1. 0.753 in
2. 0.703 in
3. 0.628 in
4. 0.517 in

2–11. Assume that the graduation mark 5 on the thimble is opposite point X. How much farther do you open the micrometer in turning the thimble until the graduation mark 15 is opposite the point for the first time?

1. 0.125 in
2. 0.010 in
3. 0.0125 in
4. 0.0010 in

2–12. How do you find the actual mechanical advantage that a jackscrew provides in lifting a load?

1. Multiply the length of the jack handle by the radius of the screw and then divide by the pitch of the screw
2. Divide the load by the amount of effort required to lift the load
3. Multiply the length of the jack handle by 2 and then divide by the pitch of the screw
4. Divide the distance the screw travels by the number of turns it makes and then subtract the amount of frictional resistance

2–13. If a jackscrew has a pitch of 5/32 inch, the length of the handle required to obtain a theoretical mechanical advantage of 800 is about

1. 30 in
2. 25 in
3. 20 in
4. 15 in

2–14. If a jackscrew requires a force of 15 pounds at the end of the handle to lift a 3,000 pound load, its actual mechanical advantage is

1. 4,500
2. 2,000
3. 450
4. 200

2–15. Which of the following describes the cut of the threads in a screw gear?

1. One end has left–hand threads and the other has right–hand threads
2. Both ends have left–hand threads
3. Both ends have right–hand threads
4. One end has a greater pitch and less depth than the other

2–16. Two Seamen are using a quadrant davit to put a large lifeboat over the side. If the operating handle is released while the boat is being lowered, the boat is kept from falling by means of

1. a friction brake on the operating handle
2. a davit arm and swivel
3. a counterweight
4. self–locking threads on the screw

2-17. Gears serve all of the following purposes EXCEPT

1. eliminating frictional losses
2. changing the direction of motion
3. increasing or decreasing the applied force
4. increasing or decreasing the speed of the applied motion

2-18. What condition must hold true if two gears are to mesh properly?

1. The teeth of both gears must be the same size
2. Both gears must have the same diameter
3. The teeth must be cut slanting across the working faces of the gears
4. The gears must turn on parallel shafts

2–19. Herringbone gears are sometimes used instead of single helical gears in order to

1. change the direction of motion
2. increase the mechanical advantage
3. increase the gear ratio
4. prevent axial thrust on the shaft

2–20. If you should find it necessary to transmit circular motion from a shaft to a second shaft, which is at right angles to the first shaft, which of the following gear arrangements should you use?

1. Internal and pinion gears
2. Miter gears
3. Spur gears and idler
4. Rack and pinion gears

2–21. In a worm and spur gear arrangement, the worm gear is single–threaded and has six threads, and the spur gear has 30 teeth. In order to turn the spur gear one complete revolution, the worm gear must be given how many complete turns?

1. 5
2. 30
3. 50
4. 180

2-22. If the worm gear in the worm and spur gear arrangement in question 2–21 were triple–threaded, the number of times the worm gear would have to be turned in order to produce one complete revolution of the spur gear would be

1. 3 times
2. 10 times
3. 15 times
4. 60 times

2-23. You have a pinion gear with 14 teeth driving a spur gear with 42 teeth. If the pinion turns at 420 rpm, what will be the speed of the spur gear?

1. 42 rpm
2. 140 rpm
3. 160 rpm
4. 278 rpm

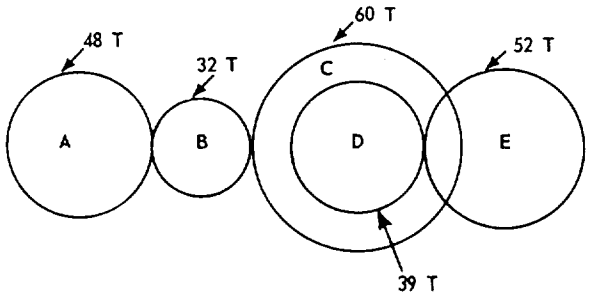

Figure 2B

For items 2-24 through 2-28, refer to the gear system in figure 2B and to the symbols which follow.

Gears C and D are rigidly attached to one another.

S_a = speed of gear A
S_b = speed of gear B
S_c = speed of gear C
S_d = speed of gear D
S_e = speed of gear E
A = number of teeth on gear A
B = number of teeth on gear A
C = number of teeth on gear C
D = number of teeth on gear D
E = number of teeth on gear E

2-24. Given S_a, A, and B, a formula for testing S_b is

1. $S_a/S_b = A/B$
2. $S_b/S_a = A/B$
3. $S_aS_b = AB$
4. $S_b = B/A - S_a$

2-25. Given S_a, A, B, C, D, and E, a formula for finding S_e is

1. $S_e = S_a\frac{(ABD)}{(BCE)}$

2. $S_e = S_a\frac{(ABE)}{(CDE)}$

3. $S_e/S_a = E/A$

2-26. Gear A would make how many revolutions for every complete revolution of gear C?

1. 4/5
2. 1 1/5
3. 1 1/4
4. 1 1/2

2-27. Which formula is used for finding the mechanical advantage of the system of gears including only gears B, C, D, and E, assuming that power is applied to gear B?

1. $\frac{C}{B} \times \frac{E}{D}$

2. $\frac{B}{C} \times \frac{D}{E}$

3. $\frac{C}{B} + \frac{E}{D}$

4. $\frac{B}{C} + \frac{D}{E}$

2-28. Assuming that power is applied to gear A, the entire gear train will have a mechanical advantage of

1. 0.67
2. 1.67
3. 3.34
4. 6.68

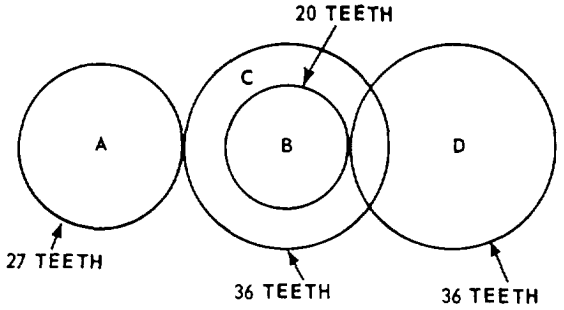

Figure 2C

2-29. Gears B and C in the gear arrangement shown in figure 2C are rigidly fixed together. If gear A is turned counterclockwise at a rate of 120 rpm, in what direction and at what rate will gear D turn?

1. Clockwise at 20 rpm
2. Clockwise at 50 rpm
3. counterclockwise at 50 rpm
4. Counterclockwise at 100 rpm

2-30. The product of all the driving teeth of a turbine reduction gearing is 400 and the product of the driven teeth is 4,000. When the output shaft turns at 200 rpm, the turbine turns at

1. 200 rpm
2. 400 rpm
3. 2,000 rpm
4. 4,000 rpm

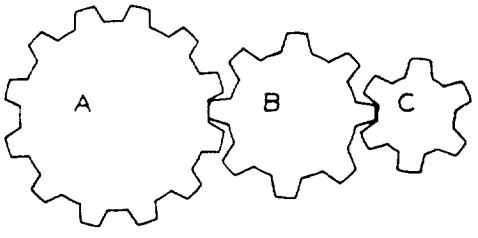

Figure 2D

2-31. The speed ratio of the gear train in figure 2D is 2 to 1. If gear B is removed and gear C is placed so that it runs directly off gear A. the speed ratio will be

1. 2.0 to 1
2. 2.4 to 1
3. 3.0 to 1
4. 4.0 to 1

2-32. The purpose of an idler gear is to

1. increase the speed ratio
2. take up lost motion
3. change the direction of rotation
4. keep another gear in place

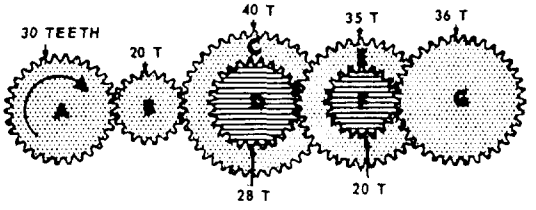

Figure 2E

Items 2-33 through 2-36 are based on the gear train shown in figure 2E.

2-33. Which gear serves as an idler gear?

1. D
2. C
3. B
4. A

2-34. If gear A turns at 300 rpm, how fast does gear G turn?

1. 180 rpm
2. 100 rpm
3. 87 rpm
4. 80 rpm

2-35. What is the mechanical advantage of the train?

1. Five
2. Two
3. Three
4. Four

2–36. The direction of rotation of gear G is counterclockwise.

1. True
2. False

Use the following information to compute the mechanical advantage of textbook figure 6–1: Gear A radius = 2 inches; Gear A teeth = 36; Gear B and C teeth = 8; handle turn radius = 1 1/2 inches.

2–37. The mechanical advantage of the eggbeater is

1. 1/8
2. 1/6
3. 1/4
4. 1/2

2–38. Refer to textbook figure 6-3B. What is the function of this gear arrangement if the pinion is driving the internal gear?

1. To increase speed
2. To magnify force
3. To change direction of motion
4. To change rotary motion into linear motion

2–39. Refer to the left–hand half of figure 6-12 in your textbook. Which of the following statements best describes the action of the valve as the camshaft rotates 180° from its position as shown in the figure?

1. The valve remains closed
2. The valve opens and stays open
3. The valve opens and then closes
4. The valve opens and closes twice

2–40. A foot–pound is defined as the amount of

1. force developed by a one–pound weight falling a distance of one foot
2. energy required to lift a one–pound weight
3. power required to overcome a resistance of one pound
4. work required to overcome a resistance of one pound through a distance of one foot

2-41. Which of the following is an example of work?

1. Holding two pieces of glued wood in a vise
2. Rolling a barrel up a gangplank
3. Changing water to steam
4. Burning a log in a fireplace

2–42. When you calculate the amount of work you have done on an object, the factors which you must always measure are the

1. resistance encountered and the distance it is moved
2. weight of the object and the distance it is moved
3. angle at which force is applied and weight of the object
4. time required to move the object and resistance encountered

2–43. Assume that you must apply a force of 150 pounds to overcome the resistance of a crate weighing 350 pounds. In moving the crate up an inclined plane which is 12 feet long, how much work do you do?

1. 4,200 ft–lb
2. 1,800 ft–lb
3. 350 ft-lb
4. 150 ft–lb

Information for items 2–44 through 2–46: You are using a first–class lever to raise a 400–pound load to a height of 1 foot. The effort arm of your lever is 8 feet long and the resistance arm is 2 feet long.

2–44. How much work is done in raising the load?

1. 400 ft–lb
2. 300 ft–lb
3. 200 ft–lb
4. 50 ft–lb

2–45. How far must you move the lever in order to raise the load 1 foot?

1. 1 ft
2. 2 ft
3. 8 ft
4. 4 ft

2-46. How much work is done in balancing the load at the 1-foot height?

1. 0 ft–lb
2. 2 ft–lb
3. 8 ft–lb
4. 10 ft–lb

2–47. By using a machine to move an object you can

1. decrease the amount of work to be done
2. reduce the weight of the object
3. decrease the amount of the effort required
4. reduce the resistance of the object

Information for questions 2–48 through 2–51: You are using a 24,000–pound load with a screwjack that has a pitch of 1/4 inch and a 24-inch handle.

2–48. Theoretically, (by neglecting friction), you should be able to turn the jack handle by exerting an effort of about

1. 24 lb
2. 40 lb
3. 60 lb
4. 80 lb

2-49. Because of friction. you actually have to apply a 120–pound force to turn the jack handle. About how much work do you do in turning the handle one complete revolution?

1. 120 ft–lb
2. 240 ft–lb
3. 1,500 ft–lb
4. 3,000 ft–lb

2–50. With each revolution of the jack handle, the work output of the jack equals

1. 100 ft-lb
2. 200 ft-lb
3. 500 ft–lb
4. 600 ft–lb

2–51. The efficiency of the jack is

1. 12 1/2%
2. 33 1/3%
3. 50 %
4. 66 2/3%

Information for questions 2–52 through 2–54: You push with a force of 125 pounds to slide a 250–pound crate up a gangplank. The gangplank is 12 feet long and the upper end is 5 feet above the lower end.

2–52. What is the theoretical mechanical advantage of the gangplank?

1. 1
2. 2
3. 2.4
4. 12

2-53. How much of your 125–pound push is used to overcome friction?

1. 21 lb
2. 42 lb
3. 62 1/2 lb
4. 125 lb

2-54. What is the efficiency of the gangplank?

1. 25%
2. 50%
3. 75%
4. 83.3%

Information for questions 2–55 and 2–56: You want to raise an 1,800–pound motor 4 feet up to a foundation. You use two double–sheave blocks rigged to give a mechanical advantage of 4 and a windlass that has a theoretical mechanical advantage of 6.

2–55. Assuming 100 percent efficiency, how much work is required to raise the motor?

1. 1,800 ft-lb
2. 3,600 ft–lb
3. 7,200 ft–lb
4. 10,800 ft–lb

2–56. Neglecting friction, how much pull must you exert to raise the motor?

1. 18 lb
2. 36 lb
3. 75 lb
4. 300 lb

2-57. An effect which friction has on the mechanical advantage of any machine is to make the

1. theoretical mechanical advantage less than the actual mechanical advantage
2. actual mechanical advantage less than the theoretical mechanical advantage
3. actual mechanical advantage less than one
4. actual mechanical advantage more than one

2–58. Assume that the hammer of a pile driver weighs 1,000 pounds. The resistance of the earth is 6,000 pounds. If the hammer drops 4 feet to drive a pile, how far into the earth will the pile be driven? (Assume an efficiency of 100%.)

1. 2 in
2. 6 in
3. 8 in
4. 10 in

When answering questions 2–59 through 2–61, assume that a man lifts a 600–pound load, using a block and tackle with a theoretical mechanical advantage of 6. He does 6,500 foot–pounds of work in lifting the load 8 feet.

2-59. How much work does the man do in overcoming friction?

1. 215 ft–lb
2. 813 ft–lb
3. 1,700 ft-lb
4. 5,900 ft–lb

2–60. The total force exerted by the man in lifting the load is approximately

1. 35 lb
2. 135 lb
3. 215 lb
4. 406 lb

2–61. The average amount of force which the man exerted to overcome friction is approximately

1. 35 lb
2. 215 lb
3. 237 lb
4. 406 lb

2–62. The handle of a screwjack must move through a circular distance of 600 inches to lift a load one inch. If a force of 10 pounds is required to lift a load of 1,500 pounds, what is the efficiency of the jack?

1. 25%
2. 33%
3. 78%
4. 90%

2-63. A block and tackle has a theoretical mechanical advantage of 4 but requires a force of 50 pounds to lift a 160–pound load. The efficiency of the block and tackle is

1. 60%
2. 70%
3. 80%
4. 90%

2-64. In a certain machine, the effort moves 20 feet for every foot that the resistance moves. If the machine is 75 percent efficient, the force required to overcome a resistance of 300 pounds is

1. 15 lb
2. 20 lb
3. 25 lb
4. 30 lb

2-65. If a block and tackle has a theoretical mechanical advantage of 5 and an efficiency of 60 percent, the amount of force necessary to lift a 1,200-pound load is

1. 30 lb
2. 150 lb
3. 400 lb
4. 720 lb

2-66. Which of the following statements concerning the relationship of work output and work input of a machine is correct?

1. The output is the same as the input
2. The output is greater than the input
3. The output is less than the input
4. The output has no relationship to the input

2-67. The amount of work done divided by the time required is called

1. energy
2. resistance
3. force
4. power

When answering questions 2-68 through 2-73, assume 100 percent efficiency in each situation and use the appropriate power formula to calculate the unknown quantity.

2-68. A motor-driven hoist lifts a 165-pound load to a height of 50 feet in 30 seconds. How much power does the motor develop?

1. 1/4 hp
2. 1/2 hp
3. 3 hp
4. 10 hp

2-69. A power winch is capable of lifting a 440-pound load a distance of 5 feet in 1 second. The driving motor works at the rate of

1. 1/2 hp
2. 1 hp
3. 2 hp
4. 4 hp

2-70. What is the horsepower of the engine driving the pump that lifts 9,900,000 pounds of water per day from a lake to the top of a standpipe, a vertical distance of 120 feet? The engine runs at a uniform speed 12 hours a day.

1. 12 hp
2. 15 hp
3. 24 hp
4. 50 hp

2-71. While a propeller-driven aircraft travels at a speed of 120 mph, its engine develops 1,500 hp. Approximately what force in pounds is being exerted by the propeller?

1. 850 lb
2. 5,000 lb
3. 15,000 lb
4. 30,000 lb

2-72. What is the horsepower of a hoisting engine that can raise 6,000 pounds through a height of 44 feet in one minute?

1. 3 hp
2. 4 hp
3. 8 hp
4. 12 hp

2-73. An annunition hoist is powered by a 2-hp motor. Working at full load, how long does it take the motor to raise a 50–pound shell 22 feet from the handling room to the gun turret?

1. 1/2 sec
2. 1 sec
3. 1 1/2 sec
4. 2 sec

2–74. If it is desired to develop ten usable horsepower from an engine which is 50 percent efficient, the engine must have a minimum rated horsepower of at least

1. 10
2. 20
3. 100
4. 150

2–75. What information is sufficient to find the horsepower rating of a motor by means of the Prony brake in figure 8–3 of the textbook?

1. The readings on both scales, the radius of the pulley, and the time it takes the motor to reach maximum speed
2. Tile readings on both scales. the radius of the pulley, and the speed of the motor
3. The readings on both scales, the radius of the pulley, and the diameter of the motor shaft.
4. The radius of the pulley and the readings on the scales when the belt is pulled tight enough to prevent the motor from turning